29 January 2013 Last updated at 13:15 GMT

**What are long term threats of plastic in our seas?**

By Susan Watts Newsnight Science editor, BBC News



Albatross parents feed their young chicks plastics and unwittingly kill them/ On the remote beaches of the French Frigate Shoals, turtles nests among plastic debris

Last summer, when filming for a series to be broadcast next year, a team from the BBC's Natural History Unit saw first-hand how discarded plastic can end up thousands of miles away from where people live when they visited French Frigate Shoals, an island north west of Hawaii.

There they found turtles nesting amongst plastic bottles, cigarette lighters and toys. And they discovered dead and dying albatross chicks, unwittingly killed when their parents fed them plastic carried in as they foraged for food in the sea.

Some of the chicks die when sharp edges puncture their bodies, others from starvation as their stomachs fill with plastic they cannot digest.

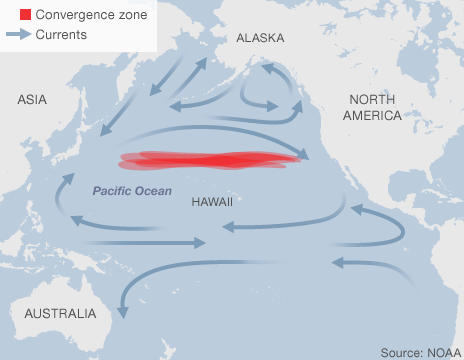
We have known for a while that plastic is a threat to the albatross, but how dangerous is discarded plastic for other wildlife and could it affect us?

Some of the plastic in our oceans has been illegally tipped at sea, or is litter from fishing, most comes from the land, from poorly run landfill sites and industrial waste.

Floating debris is carried to the Hawaiian archipelago by giant rotating ocean systems, or gyres, partly driven by air currents.

Hawaii sits in the midst of a gyre known as the North Pacific Sub-tropical High. The North Pacific gyre is one of five gigantic interconnected systems of ocean currents. Each spirals around a central point, drawing material inwards.

These spirals can also eject material, out towards the Arctic and Antarctic, spreading plastic across the globe over time.



Plastic is made to last, so it decays only very slowly in the oceans, breaking down into ever smaller fragments. These tiny fragments are known as micro-plastic.

Hormonal changes

Dr Simon Boxall is an expert in marine pollution based at the National Oceanography Centre in Southampton, on Britain's south coast. We took a boat trip with him in the sea near his research centre.

Using a simple net and bottle system, the boat filtered roughly 400 tonnes of water in 10 minutes. With the naked eye we could see mud, twigs and a few feathers, but when we looked at the sample under the microscope in Dr Boxall's laboratory tiny pieces of plastic became clear.

The sample included small pieces of plastic rope and plastic bag, some fragments were distinctly coloured and some had sharp edges. There were pieces less than a millimetre across, similar in size to the living things in our sample - the phytoplankton, or tiny plants, and zooplankton, or tiny animals.

"There's been a lot of research in the United States looking at how the plastic gets into the food chain, and certainly it's been shown that it gets into bi-valves, mussels and oysters on the seabed, and it does have an effect on them," Dr Boxall said.

"They bio-accumulate the plastic as they filter the water. That concentrates the plastic and effectively turns some of those molluscs into hermaphrodites. Some years ago it was assumed that it was like roughage, and didn't have a major impact, but we know now that those very small plastic particles can mimic certain things like oestrogen," he added.

Chemical adsorption?

However, he said the true effects are not yet known:

"These plastic particles are like sponges, they're a bit like magnets for other contaminants, things like Tributyltin, the anti-fouling material. The tiny plastic particles absorb these materials and effectively become quite toxic. We don't know yet whether that then has an impact on the human food chain. It's still very early days to find out how far up the food chains these plastic particles go."

Tiny fragments of plastic in sea water can be seen under a microscope

At the Marine Biology and Ecology centre of Plymouth University they study the impact of pollutants on our oceans and rivers, and the creatures that live in them. Marine scientist Professor Richard Thompson was the first to describe the tiny fragments of broken plastics as micro-plastics back in 2004.

"There are two concerns from a toxicological point of view. There's the issue that plastics are known to sorb and concentrate chemicals from sea water," he explained.

"And the secondary question is about chemicals that have been introduced into plastics from the time of manufacture, in order to achieve specific qualities of the plastic, its flexibility, or flame retardants or anti-microbials.

"When we've now got plastic not as whole intact items but as small fragments in the environment, is there the potential for any of those chemicals from manufacture to also be released?"

'More work needed'

Prof Thompson's team has been examining fish in the English Channel, 500 or so across 10 species - including mackerel, whiting, poor cod and gurnard.

His results have just been published in Marine Pollution Bulletin (Lusher et al, MPB, December 2012). The team found microscopic plastic in the guts of all of the species tested.

Scientists found plastic fragments in the guts of 10 fish species in the English Channel

"It's showing that micro-plastics are quite widespread in the environment, not just in the water columns and the beaches, but actually in the creatures that live in those environments," he said.

Prof Thompson said the plastics had been found "in relatively low quantities - one or two pieces per fish - so this is certainly not a risk from the point of view of the human population, people eating those fish, because of course we don't eat the guts normally".

"The question we do want to address is is that a problem from the point of view of the animals concerned, in individuals that are eating plastic, either from the point of view of the physical presence of the plastic, or the potential for chemical transport?"

I asked if that means there is a concern for people who eat the flesh of the fish, if those chemicals have found their way into the animal.

"It's really an unknown," Prof Thompson said.

"The next step is to take the information like that from fish and other creatures to understand how much plastic, what are the chemicals that might be of concern... what are the concentrations of those chemicals, what are the quantities of plastic, and how does that vary from species to species in order to understand which particular combinations might create the greatest potential for hazard...

"That's what our work is trying to establish at the moment - what potential is there for these micro-plastics to actually cause harm in the real world."